A BEAM

Technical Field

The present invention relates to a roll formed beam and a method of roll forming beam.

The invention has been primarily developed in order to produce a relatively light weight beam of substantially rectangular cross-section for use in housing and construction, most particularly home extensions, and will be described with hereinafter with reference to this application. However, it should be appreciated that the invention is not limited to this particular field of use.

Background of the Invention

One form of known, light weight construction beam, as used in home extensions, is produced by joining two roll formed channels of C-shaped cross section to form a beam of rectangular cross-section.

One disadvantage associated with this known beam is that the two channels can slip relative to each other, which can lead to the beam: warping; losing strength; and/or a making creaking noises. In extreme conditions, the two channels can kink and/or separate from one another, which generally results in the beam failing. Another disadvantage of this known beam is production is at least a two stage, two man operation involving: roll forming the two C-shaped channels; positioning the two channels in a press; and then performing a pressing operation to join the channels together.

Object of the Invention

It is an object of the present invention to substantially overcome or at least ameliorate one or more of the above prior art disadvantages.

Summary of the Invention

Accordingly, in a first aspect, the present invention provides a roll formed beam of substantially rectangular cross-section formed from a unitary piece of metal, the beam including:

opposed first and second substantially parallel walls formed with at least three adjacent layers of said piece of metal; and

opposed third and fourth substantially parallel walls between the first and second walls, one of the third or fourth walls having a seam joining two opposed longitudinal edges of the piece of metal.

Preferably, the opposed first and second walls are formed with three adjacent layers of said piece of metal.

In one form, the three layers span the entire width of the first and second walls. In another form, the three layers in the first and second walls are preferably formed from two layers of metal spanning approximately half the width of the first and second walls and one layer spanning all of the width of the first and second walls. In one embodiment, the two half width layers form the beam exterior. In another embodiment, the two half width layers form the beam interior.

The beam preferably also includes at least two, most preferably three, adjacent layers of said piece of metal in the region of its four corners and directed away from the first and second walls.

The beam preferably also includes a plurality of outwardly concave indentations in the third and fourth walls. In a preferred form the beam includes three equi-spaced indentations in each of the third and fourth walls, wherein one of the indentations is formed by the seam.

The first and second walls are preferably smaller than the third and fourth walls.

In a second aspect, the present invention provides a method of roll forming a beam of substantially rectangular cross-section from a unitary substantially flat piece of metal, the method comprising the following sequential steps:

forming a pair of spaced apart flattened sections of at least three layers of said metal in said metal piece;

folding the outer edges of the metal piece at approximately right angles to the flattened sections near the outermost end of the flattened sections;

folding the folded outer edges of the metal piece at approximately right angles to the flattened sections near the innermost end of the flattened sections; and

folding a joining seam between the adjacent outermost longitudinal edges of the metal piece.

In one form, the flattened sections are preferably formed by: forming a pair of spaced apart channels in the metal piece, the channels each having a base and two sides; and flattening the channel bases against the remainder of the metal piece with the sides therebetween.

In another form, the flattened sections are preferably formed by: forming a channel in the metal piece, the channel having a base and two sides; and flattening the channel sides against the channel base.

Preferably, the channel base(s) is/are flattened by drawing together the edges of the sides of each of the channel(s) remote the base(s).

The outer edges of the metal piece at preferably folded at approximately right angles to the flattened channel bases approximately 15% along the length of the flattened channel bases. The folded outer edges of the metal piece are preferably folded at approximately right angles to the flattened channel bases approximately 15% along the length of the flattened channel bases.

The outer edges of the metal piece at preferably folded at approximately right angles to the flattened channel bases approximately 15% along the length of the flattened channel bases. The folded outer edges of the metal piece are preferably folded at approximately right angles to the flattened channel bases approximately 15% along the length of the flattened channel bases.

The method preferably also includes forming a plurality of most preferably five, indentations into the metal piece before the folding the outer edges of the metal piece relative to the flattened channel bases. In a preferred form, three indentations are folded between the flattened channel bases and one indentation is folded into the metal piece outwardly of each flattened channel base.

Brief Description of the Drawings

Preferred embodiments of the invention will now be described, by way of example only, in relation to the accompanying drawings in which:

Fig. 1 is a cross-sectional end view of a first embodiment of a beam according to the invention;

Figs 2 to 37 are cross-sectional end views of the beam shown in Fig. 1 during sequential roll forming stages;

Fig. 38 is a roll forming flower diagram corresponding to the stages shown in Figures 2 to 21;

Fig. 39 is a roll forming flower diagram corresponding to the stages shown in Figs. 22 to 37;

Fig. 40 is a cross-sectional end view of a second embodiment of a beam according to the invention;

Figs 41 to 76 are cross-sectional end views of the beam shown in Fig. 1 during sequential roll forming stages;

Fig. 77 is a roll forming flower diagram corresponding to the stages shown in Figures 41 to 76;

Fig. 78 is a cross-sectional end view of a third embodiment of a beam according to the invention;

Figs 79 to 113 are cross-sectional end views of the beam shown in Fig. 1 during sequential roll forming stages;

Fig. 114 is a roll forming flower diagram corresponding to the stages shown in Figures 79 to 97;

Fig. 115 is a roll forming flower diagram corresponding to the stages shown in Figs. 98 to 113; and

Fig. 116 is a cross-sectional end view of a fourth embodiment of a beam according to the invention.

Detailed Description of the Preferred Embodiments

Referring firstly to Figs. 1 to 39, there is shown a first embodiment of a roll formed beam 40 of substantially rectangular cross-section formed from a unitary piece of metal 42, in accordance with the invention.

As best shown in Fig 1, the beam 40 has first and second parallel walls 44 and 46 formed from three adjacent layers 44a, 44b and 44c and 46a, 46b and 46c respectively of said metal piece 42. The beam 40 is generally installed such that, in use, the walls 44 and 46 represent the top and bottom walls of the beam 40 respectively. The beam 40 also has opposed third and fourth substantial parallel walls 48 and 50 which, in use, represent the side walls of the beam 40. The wall 48 includes a folded seam 52 which joins outermost longitudinal edges 42a and 42b of the metal piece 42, as will be described in more detail below.

The side wall 48 of the beam 40 has three outwardly concave indentations 54a, 54b and 54c formed therein. The indentation 54b is a by-product of the seam 52. The side wall 50 has three similar indentations 56a, 56b and 56c.

The triple layer top and bottom walls 44 and 46 are formed from an inner layer 44c that spans between the two side walls 48 and 50 and two half layers 44a and 44b that each span approximately half the distance between the two side walls 48 and 50. The triple layer construction of the top and bottom walls 44 and 46 adds strength to the beam 40. The triple layer construction also extends around the corners of the beam 40 from the top and bottom walls 44 and 46 in the direction of the side walls 48 and 50. This reinforces each of the side walls 48 and 50 in the regions 58, which are each of approximately 15 percent of the overall length of the side walls 48 and 50.

The beam 40 has a height of 110mm (ie. the walls 48 and 50), a width of 60mm (ie. the walls 44 and 46) and is produced from 0.55mm thickness COLORBOND (trade mark) material, as produced by BHP Steel Limited. Two other preferred sizes of beam are 160x60x0.75mm and 210x60x1.00mm.

The beam 40 is formed by the process of roll forming on a roll forming machine (not shown). The set-up and operation of a roll forming machine are well understood by persons skilled in that field and will not be described herein in any further detail.

Figs. 2 to 37 show the sequential roll forming stages the piece of metal 42 undergoes in order to form the beam 40. Fig. 38 shows a roll forming flower diagram that is equivalent to the roll forming stages shown in Figs. 2 to 21. Fig. 39 shows another roll forming flower diagram that is equivalent to the roll forming stages shown in Figs. 22 to 37. Whilst the roll forming diagrams and flower diagrams can themselves be considered self-explanatory, a general description of the roll forming operation is as follows.

Firstly, the flat piece of metal 42 is roll formed into the shape shown in Fig. 11 in which it has a pair of spaced apart channels 60 each having a base 60a and two sides 60b. The channel bases 60a are then flattened against the remainder of the metal piece 42 with the sides therebetween by folding the sides 60b under the bases 60a (see Fig. 21), to form triple layered flattened sections 62. Outer edges 64 of the metal piece 42 are then folded at approximately right angles to the flattened sections 62, near the outer edges of the flattened sections 62, into the shape shown in Fig. 30. The folded outer edges 64 of the metal piece 42 are then folded, near the inner edges of the flattened channel sections 62, to form the substantially rectangular configuration shown in Fig. 36. The two longitudinal edges 42a and 42b of the metal piece 42 are then folded into the seam 52 (as best shown in Fig. 1) to form the rectangular beam 40 shown in Fig. 37.

Figs 40 to 77 show a second embodiment of beam 70 and the method of roll forming same. Like features to those of the first embodiment of the beam 10 are indicated with like reference numerals. The beam 70 differs from the beam 10 in that the triple layer bottom and top walls 72 and 74 are formed from full width outer layers 72a, 74a and two intermediate and inner half layers 72b, 74b and 72c, 74c respectively.

Figs 78 to 115 show a third embodiment of beam 80 and the method of roll forming same. Like features to those of the first embodiment of the beam 10 are indicated with like reference numerals. The beam 80 differs from the beam 10 in that the triple layer bottom and top walls 82 and 84 are formed from three full width outer layers 82a, 82b, 82c and 84a, 84b, 84c respectively.

Figs 116 shows a fourth embodiment of the beam 90. Like features to those of the first embodiment of beam 10 are indicated with like reference numerals. The beam 90 differs from the beam 10 in that the triple layer construction (see regions 58 in Fig. 1) does not extend around its inner corners.

The embodiments of the beam described above posses many advantages over the known two part beams. Firstly, although they are slightly heavier, the beam are able to span 50 to 100% longer distances then a correspondingly sized two piece beam. Secondly, the beams have improved torsional rigidity compared to the known two part beams of a corresponding size. Thirdly, the beams can be produced by a single man, single roll forming operation which results in lower labour costs, lower plant costs and reduced manual handling. Fourthly, the beams can be produced from a variety of materials, including pre coated metal products which require no further surface finishing. Finally, the beams are aesthetically pleasing with the indentations serving to both replicate the appearance of a steel or timber beam and to camouflage the seam.

Although the invention has been described with reference to specific examples, it would be appreciated by those skilled in the art that the invention may be embodied in many other forms.